Original Research Article

The Efficacy of Collagen and Silver Sulphadiazine in Treating Partial Thickness Burns – A Prospective Comparative Study

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Abstract

Background: Burn injuries present a major public health hazard and topical management of burns is a challenging task. Conventional dressings like Silver sulfadiazine have disadvantages of multiple dressings, prolonged hospital stay, more pain, etc. whereas Collagen dressings have the advantage of single application, less pain and less infection. The objective of the study was to compare the overall outcome of collagen dressings in comparison with conventional dressings like silver sulfadiazine in terms of duration of hospital stay, scar formation, occurrence of infection & patient compliance. **Methods:** This prospective hospital based comparative study was carried out at Sri Venkateshwaraa Medical College hospital, Puducherry, India. Total number of patients were 54 who were divided equally into 2 groups. (Group 1): Those who were treated with silver sulfadiazine (SSD), (Group 2): Those who were treated with Collagen dressing. The following variables were compared: Pain score, rate of wound infection, rate of scar formation, duration of hospital stay & patient compliance. The data was entered; tabulated and statistical analysis was performed by using Statistical Package for the Social Sciences (SPSS 24.0). A value of $p<0.05$ was considered statistically significant. **Results:** This study enrolled a total of 54 patients, out of which 27 people belonged to the SSD group and 27 belonged to the Collagen group. Around 70% of the patients were males and 30% of the patients were females. Age distribution between two groups showed that the average age of individuals included in both the groups were 42.18±12.26 years. The average pain score in SSD group was 6.92 whereas in Collagen dressing group was 2.64 ($p<0.0001$). Infection was present in 43% of the patients in SSD group (11 patients) and 14 % in Collagen group (4 patients). The duration of hospital stay in SSD group was 14.67±2.28 days and in collagen group was 10.62±2.28 days. Rate of scar formation in SSD group was 86% and in collagen group was 29%. Patient compliance in SSD group was 57.1% and in collagen group was 85.7%. **Conclusion:** The current study concludes that patients with partial thickness burns who were treated with Collagen dressing had less pain, lesser risk of infection, shorter hospital stay, decreased rate of scar formation and a better patient compliance in comparison with traditional Silver sulfadizine dressing.

Keywords: Burns, Collagen, Silver sulfadiazine, Pain score, Wound infection, Patient compliance

Introduction

Burn injuries present a major public health hazard in both adult and pediatric population worldwide [1]. The World Health Organization (WHO) defines burns as destruction of some or all layers of the skin, when they come in contact with hot liquids (scalds), hot solids (contact) or flame (flame burns) or due to lightning and radiation injury. The process and problems of wound healing should be considered seriously [1]. As per the WHO, burns account for an estimated 300,000 deaths annually. In India, over 100,000 people are moderately or severely burnt every year. Long-term morbidity is often a significant problem for burn survivors [1].

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Burns injury is a common emergency encountered by surgeons. Its pathophysiology and occurrence are complex [2-4]. Understanding of the physiology and metabolic interactions and involvement of major organ systems, nutrition, immunology, psychological issues is inevitable for the optimal management of these patients. It is a painful condition [5-7].

Topical management of burns is a challenging task. An ideal topical dressing should allow faster healing with reduction of pain, prevent infection, should lead to less scar formation and should be cost effective as well. Traditional burns wound management involves cleansing, debridement, and provision of a moist environment to encourage the process of natural healing [8].

Silver sulfadiazine (SSD) dressings are conventional dressings which has been largely practised in India. Studies have concluded that SSD has disadvantage of the large number of dressings, prolonged hospital stay, more amount of pain, loss of time and labor [9-11]. This is where the emerging biological dressings like collagen are playing a vital role in overcoming the disadvantages of conventional dressings like SSD. Extensive researches on collagen and its properties favours the use of collagen dressing for burns patients. The term collagen originated from the Greek word 'Kola', meaning glue plus gene. 25%

of total protein in human body and about 70% to 80% of skin is constituted by collagen. Various new dressing materials like calcium alginate, hydro-colloid membranes and fine mesh gauze were developed during the last decade. The importance of collagen in healing has been appreciated for many years for the simple reason that the end result of wound healing is always a scar which is composed of collagenous fibres [12].

Collagen dressings are impermeable to bacteria, haemostatic, nonpyrogenic, hypoallergenic, pain-free, have low antigenicity, give mechanical support for connective tissue by forming a substrate for cellular adhesion and migration. Recent studies have concluded that collagen dressings are more cost effective than SSD as it is a single time procedure most of the time and have also concluded that collagen dressings are superior to conventional dressings in wound healing of burns. Other advantages over conventional dressings are in terms of ease of application and being natural, non-immunogenic, non-pyrogenic, hypoallergenic, and pain-free [13-16].

There is a need to compare the overall outcome of collagen dressings in comparison with conventional dressings like silver sulfadiazine in terms of duration of hospital stay, scar formation, occurrence of infection & patient compliance in order to ascertain whether they are really superior to conventional dressings like SSD.

In view of this, this prospective hospital based comparative study carried out at Sri Venkateshwaraa Medical College Hospital, Puducherry, India was aimed to compare the overall outcome of collagen dressings in comparison with conventional dressings.

Objectives of this study assessment of overall outcome of collagen dressings in comparison with conventional dressings in terms of pain score, duration of hospital stay, scar formation, occurrence of infection & patient compliance.

Method

This study was carried out at Sri Venkateshwaraa Medical College Hospital, Puducherry, India with 54 patients. Patients diagnosed with partial thickness burns from the year-2019 to the year-2021 were included in the study. Patients with full thickness burns, burns involving <20% to >40% of the total body surface area, electrical and other non-thermal burns, and burn wounds older than 24 hours, facial burns and perineal burns were excluded from the study. Total number of patients were 54 who were divided equally into 2 groups (27 in each) (Group 1): Those who were treated with silver sulfadiazine (SSD), (Group 2): Those who were treated with Collagen dressing. The following variables were compared:

a)Pain score – Visual Analog Scale (VAS) was assessed after 24 hours of the application of dressing.

b)Infection in the burn wounds were assessed visually by presence or absence of any pus beneath the dressing.

c)Scar formed at the burn wound sites is marked as good or bad depending upon the degree of contracture.

d)Duration of hospital stay

e)Compliance is elicited by the feedback given by the patient.

The study protocol was performed in accordance with the principle of the declaration of Helsinki and after approval by the Institutional ethical review board.

Statistical analysis

The data was entered; tabulated and statistical analysis was performed by using Statistical Package for the Social Sciences (SPSS 24.0). Univariate analysis of continuous quantitative variables was performed with the Independent-t test and Pearson chi-square test. A value of $p<0.05$ was considered statistically significant.

Results

This study enrolled a total of 54 patients. Age distribution between two groups showed that the average age of individuals included in both the groups were 42.18±12.26 years. Out of a total of 54 patients, 27 people belonged to the SSD group and remaining 27 belonged to the Collagen group. Around 70% of the patients were males and 30% of the patients were females. The average pain score in SSD group was 6.92 whereas in Collagen dressing group was 2.64 ($p<0.0001$)

Pain Score

Table 1: Measurement of pain score (VAS) at 24 hours for both study groups (SSD and collagen dressing)

Study Group	Mean Pain at 24 Hours	*p* value
SSD	6.92	< 0.0001
Collagen dressing	2.64	

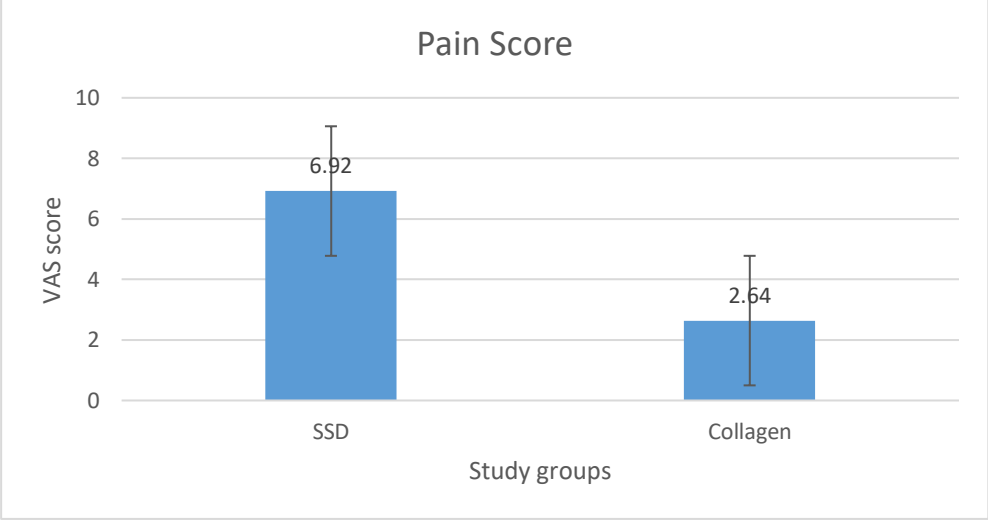

Fig 1: Measurement of pain score (VAS) at 24 hours for both study groups (SSD and collagen dressing)

Pain score was measured using VAS scoring scale at 24 hours in both the groups as represented in above table 1 and figure 1. The average pain score in SSD group was 6.92 whereas in Collagen dressing group was 2.64 ($p<0.0001$). The Pain score in both the groups calculated using VAS scale showed high pain score in the SSD group compared to the Collagen dressing group at 24 hours which indicates the patients who had undergone dressing with collagen had comparatively lesser pain.

Rate of Infection

Table 2: Measurement of Rate of Infection for both study groups (SSD and collagen dressing)

Study Group	Rate of Infection	*p* value
SSD	43%	0.237
Collagen dressing	14%	

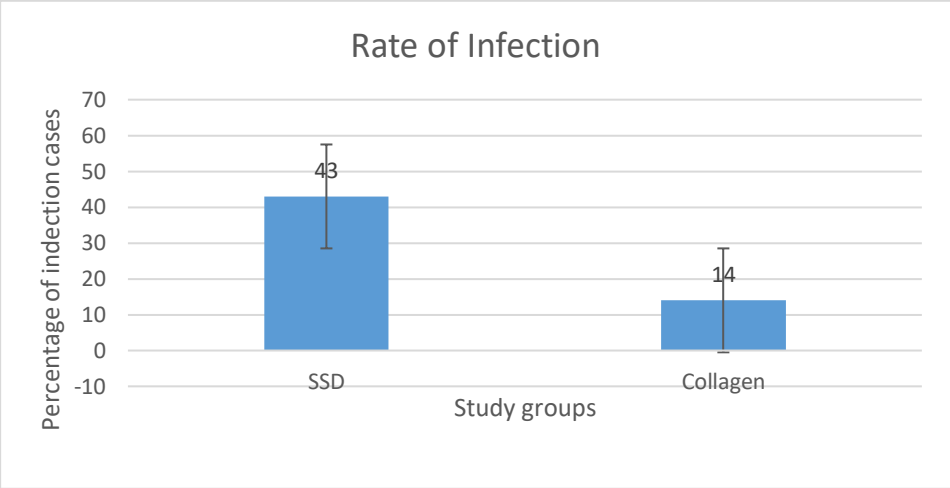

Fig 2: Measurement of Rate of Infection for both study groups (SSD and collagen dressing)

Infection in the burn wounds were assessed visually by presence or absence of any pus beneath the dressing. Infection was present in 43% of the patients in SSD group (11 patients) and 14 % in Collagen group (4 patients). It was observed that the rate of wound infection in patients who underwent collagen dressings were lesser than that of patients who underwent SSD. However, our study could not observe any significant statistical difference for rate of infection between study groups (SSD and collagen dressing).

Duration of Hospital Stay

Table 3: Measurement of Duration of Hospital Stay (in days) for both study groups (SSD and collagen dressing)

Study Group	Duration of Hospital Stay (in days)	*p* value
SSD	14.67±2.28	<0.0001
Collagen dressing	10.62±2.28	

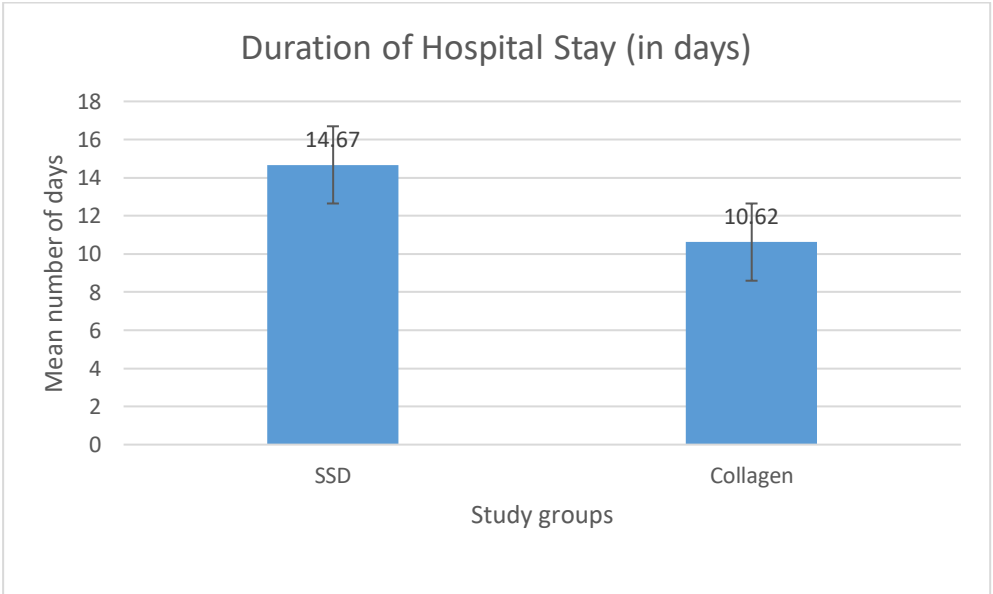

Fig 3: Measurement of Duration of Hospital Stay (in days) for both study groups (SSD and collagen dressing)

Duration of Hospital stay was calculated from the date of procedure till the date of discharge. The mean duration of hospital stay in SSD group was 14.67±2.28 days and in collagen group was 10.62±2.28 days. It was observed that the patients who underwent collagen dressing stayed in the Hospital for a shorter period and hence got discharged earlier than the patients who underwent SSD. Our study observed significant statistical difference for mean duration of hospital stay (in days) between study groups (SSD and collagen dressing).

Patients with scar formation

Table 4: Measurement of percentage of patients with scar formation for both study groups (SSD and collagen dressing)

Study Group	Patients with scar formation (%)	*p* value
SSD	86%	<0.001
Collagen dressing	29%	

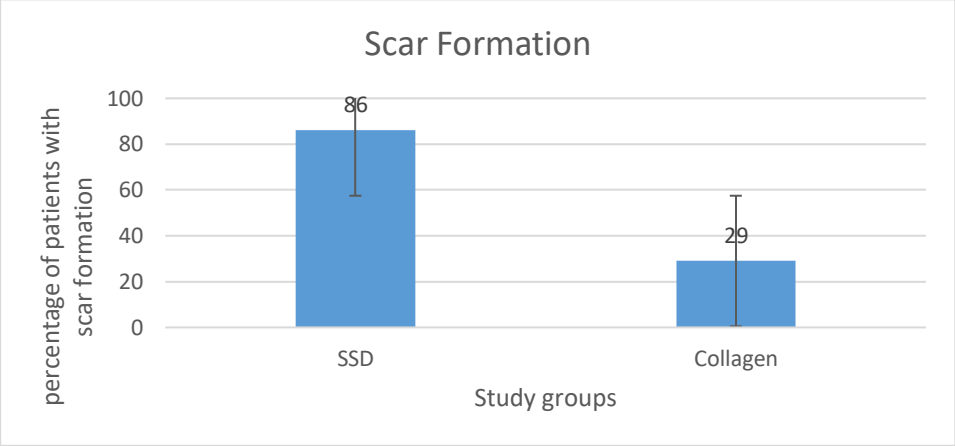

Fig 4: Measurement of percentage of patients with scar formation for both study groups (SSD and collagen dressing)

Scar formation was assessed by the degree of contracture of the wound. In our study 86% of patients who underwent SSD had scar formation whereas only 29% of the patients who underwent Collagen dressing were found to have scar formation. It was observed that the patients who underwent collagen dressings had resulted with lesser scar formation than that of the patients who underwent SSD. Our study observed significant statistical difference for percentage of patients with scar formation between study groups (SSD and collagen dressing).

Patient Compliance

Table 5: Measurement of Patient Compliance rate for both study groups (SSD and collagen dressing)

Study Group	Patient Compliance (%)	*p* value
SSD	57.10%	<0.001
Collagen dressing	85.7%	

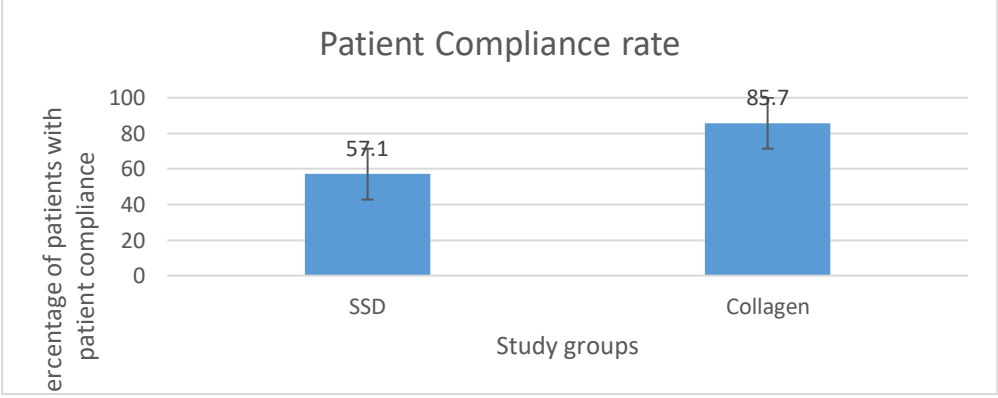

Fig 5: Measurement of Patient Compliance rate for both study groups (SSD and collagen dressing)

Patient compliance for both the dressings was derived from the feedbacks which were received from the patient themselves. Patient compliance in SSD group was found to be 57. 1% whereas in Collagen dressing compliance was found to be 85.7 %. It was observed that the patients who underwent collagen dressing had better patient compliance rate than that of the patients who underwent SSD dressing. Our study observed significant statistical difference for Patient Compliance rate between study groups (SSD and collagen dressing).

Discussion

Burns is an important surgical emergency encountered in our routine practice [15]. Topical management of burns is a very challenging task. Burn Wound is devoid of keratin layer of skin which makes it vulnerable to infections. Absence of skin barrier leads to continuous loss of body heat, fluid and electrolytes. Burn area lacks the scaffold of collagen. This makes the wound difficult to epithelialize which results in scar and contractures. Exposed nerve endings are vulnerable to external stimuli causing pain. Therefore, a barrier is required over the burn wound to protect the underlying tissue, and that can act as a scaffold for epithelization [16-18].

Traditionally silver based dressings like silver sulfadiazine dressings were used. They are applied on the burn wound and release silver ions acting like a barrier against contamination and promotes wound healing. However these dressings lacked a physiological interface between the wound and environment and required multiple application till the wound heals [19].

Biological dressings like collagen made from bovine tissues comprising of type I and III collagen on the other hand, create the most physiological interface between the wound surface and environment as they are chemically similar to the human form of collagen and are impermeable to bacteria. Moreover collagen application is done only once thus multiple painful dressings and manipulations over the wound is prevented which in turn will also decrease the cost for multiple dressings. Also collagen dressings have added advantage of promoting angiogenesis in the affected area which increases the rate of wound healing thus decreasing the hospital stay of the patient [20].

In this study we have compared the outcome of SSD and Collagen dressings in terms of the following variables. The pain score in the first 24 hours in the collagen group was 2.64 which was 2 times less than that of in SSD group (6.92) which was consistent with the result of the study conducted by Sunil Mathew et al [2].

Another important factor that influences wound healing is the rate of infection. Our study showed the rate of infection in SSD group was 43 % which was 3 times higher than that of the rate of infection in collagen group (14%) which in turn influenced the duration of hospital stay. The patients in collagen dressing group got discharged approximately 5 days earlier (10.62±3.29) than the SSD group (14.67±2.28 days) which was consistent with the results of the study conducted by Gerding et al., which had concluded that the biobrane therapy can significantly reduce the duration of hospital stay [6].

Scar formation and contractures are a major hinderance in burns patients hence we compared the rate of scar formation in our study which concluded that the rate of scar formation in SSD (83.7 %) was two times more than that of the collagen group (36.7 %) which was consistent with the results of the study conducted by Sunil Mathew et al [2].We also compared the patient compliance rate which is an important goal for all the Surgeons treating their patients. In our study we assessed the patients compliance rate by receiving feedbacks from the patients directly which concluded that the rate was more in collagen group (85.7 %) than that of the SSD group (57.1%) which was similar to the results of the studies conducted by Gerding et al [6], Ostlie et al [17] and Barret et al [21].

Conclusion

In conclusion, we summarize that patients with partial thickness burns who were treated with collagen dressing had less pain, lesser risk of infection, shorter hospital stay, decreased rate of scar formation and a better patient compliance in comparison with traditional Silver sulphadizine dressing. However, additional studies with larger populations are required to determine the efficacy of collagen dressing in treating partial thickness burns.

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